Rural Wireless - “Boomer Cells”

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Wireless/Cellular coverage in Australia

- 98% of the Australian population have mobile phone coverage in their residences. This results from a long history of both government intervention and commercial drivers.
- A key consideration in the closure of Telstra's AMPS network in 2000 was that the replacement CDMA coverage together with existing GSM coverage be reasonably equivalent to the previous AMPS coverage.
- The government has had significant programs since 2000 that subsidize the capital cost of extending mobile coverage on highways and to communities as small as 500 inhabitants
- $23m for mobile phones on highways program was awarded to Vodaphone and provides coverage on over 10,000 km on 16 highways.
- $22m for mobile phone coverage for towns with a population of 500 or more was awarded to Telstra.
- $49m regional mobile phone program is being used to fund other ways of providing greater access to affordable mobile telecom in areas currently without terrestrial services. The funds were awarded to Telstra and largely used to extend CDMA coverage.

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Wireless/Cellular coverage in Australia (2)

- Other programs not directed to mobile phone infrastructure have had the effect of extending it:

  - Networking the Nation funded some mobile phone infrastructure which was party funded by the local communities.

  - The extended zone tender was awarded to Telstra and the requirements will be partly met using CDMA WLL but by using CDMA it is having the effect of greatly extending the coverage of the CDMA network.

  - Today the coverage of Telstra CDMA is more than twice that of the next biggest network (Telstra GSM) and this coverage will continue to grow as the programs above are implemented. Over 98% of Australian residences have mobile phone coverage but there is now a public expectation that all homes and highways should be covered.

  - Boomer cells have played a major role in economically extended coverage across sparely populated rural and remote areas.

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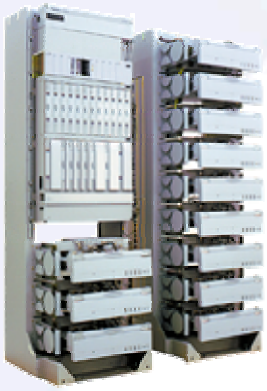
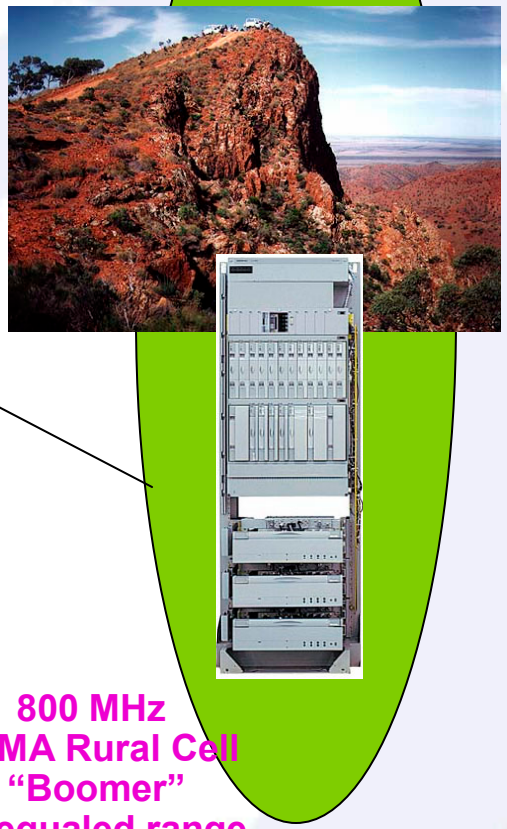
CDMA Metro Cell Family



800/1900 MHz
CDMA Mini Radio Enclosures
Indoor/Outdoor
(can be used with any BTS type)



800/1900 MHz
CDMA Metro Cell
Indoor & Outdoor
High Capacity
768 Channel Elements

800/1900 MHz
CDMA Minicell
Outdoor
Flexible Deployment
Inbuilding/Highway

800 MHz
CDMA Rural Cell
"Boomer"
Unequaled range
240km range

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The Compelling Market Issues

- **Why would an operator be interested in Rural Coverage Solutions?**
  - To extend coverage for EXISTING subscribers when they travel / drive from their urban center
  - Reduce AMPS roaming expenses (ie capture 100% of the subscriber's wireless expenditure) with reduced vendor equipment / site acquisition costs
  - Cover more NEW subscribers as urban markets are saturated
  - Maximize the 3G opportunity

- **Subscriber Dynamics**
  - Subscribers have been trained to expect seamless voice service
    - Achieved through direct CDMA service + service using AMPS network + service through roaming agreements.
  - Subscribers will expect seamless 3G Data services
  - Subscribers only get seamless 3G Data services if directly covered by a 3G network
  - IS-95 CDMA network + AMPS network + roaming agreements must be replaced by 3G Data networks, both urban and rural.

EXCEED CUSTOMER EXPECTATION BY PROVIDING SEAMLESS 3G SERVICES

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Rural Coverage Issues to Understand

- Diminishing returns from maximizing site coverage
  - Targeting cell coverage to a particular area the size of a roadway from great distances is difficult
  - Quality of coverage is limited by:
    - Terrain: hills create coverage shadows, valleys create coverage holes
    - Curvature of the earth: limits the effective distance that straight line coverage can achieve – mitigated by increasing tower height.
- Matching the forward link power with the reverse link sensitivity.
  - More power on the forward link does not necessarily provide extra cell coverage.
  - Reverse link budget determines maximum cell radius in a coverage limited application
- Coverage vs Capacity
  - As forward link pilot power is increased to achieve a maximum sized cell radius, more PA power is necessary to serve subscribers on the outer edge of the cell which may reduce capacity.
  - The art of deploying rural coverage solutions is to manage the coverage vs the capacity requirements
- 800 MHz vs 1900 MHz coverage comparisons
  - 800 MHz cells will generate greater effective cell sizes than 1900 MHz cells.
    - Propagation losses of 1900 MHz spectrum reduces the effective size of the cell compared to a similar 800MHz cell (assuming equivalent mobile transmit power).

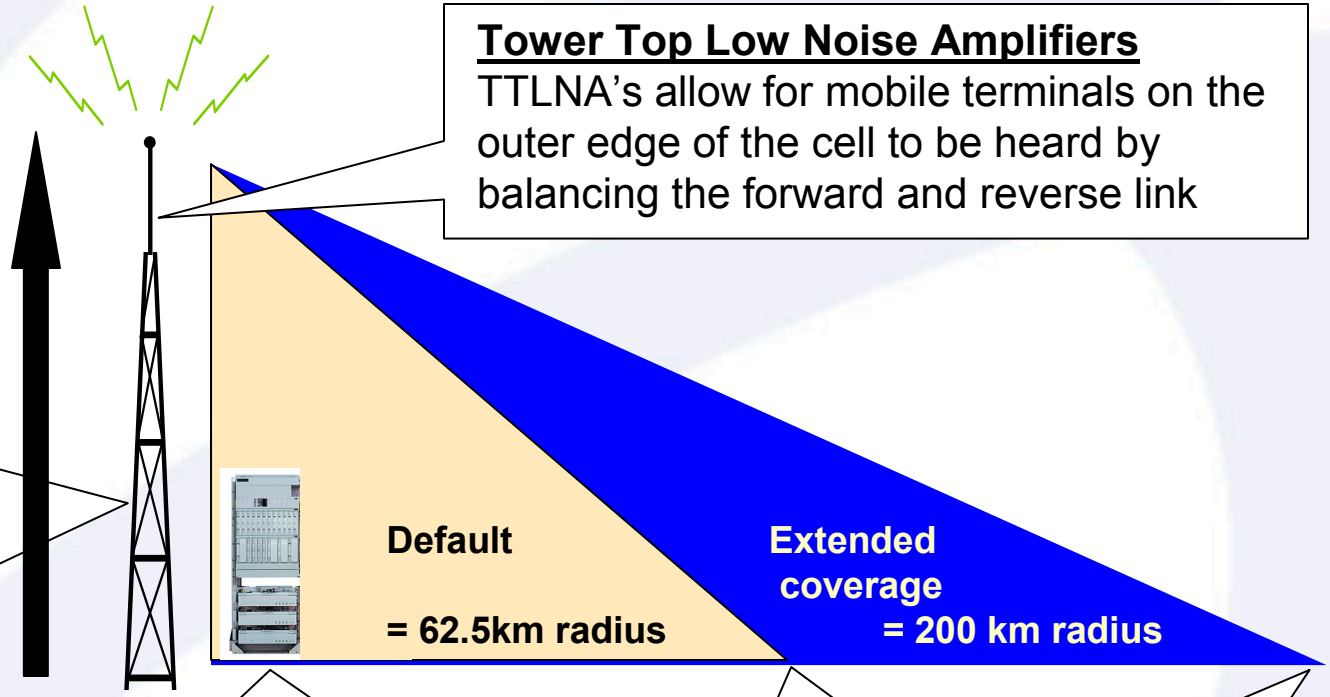
Rural Coverage Basic Concepts

What can be different at a rural coverage site compared to an urban site?

Tower Top Low Noise Amplifiers
TTLNA's allow for mobile terminals on the outer edge of the cell to be heard by balancing the forward and reverse link

Tower Height

Additional tower height allows for additional coverage by mitigating curvature of the earth effects and terrain related coverage holes.



High Power PA's and Channel Elements
A high power PA generates the necessary forward link power so the mobile receives a signal from the BTS. Channel element technology mitigates CDMA timing issues

CFDS Activation
MFRM High Power keycode in combination with max coverage xCEM keycode allows the cell radius to be extended up to 200 km.

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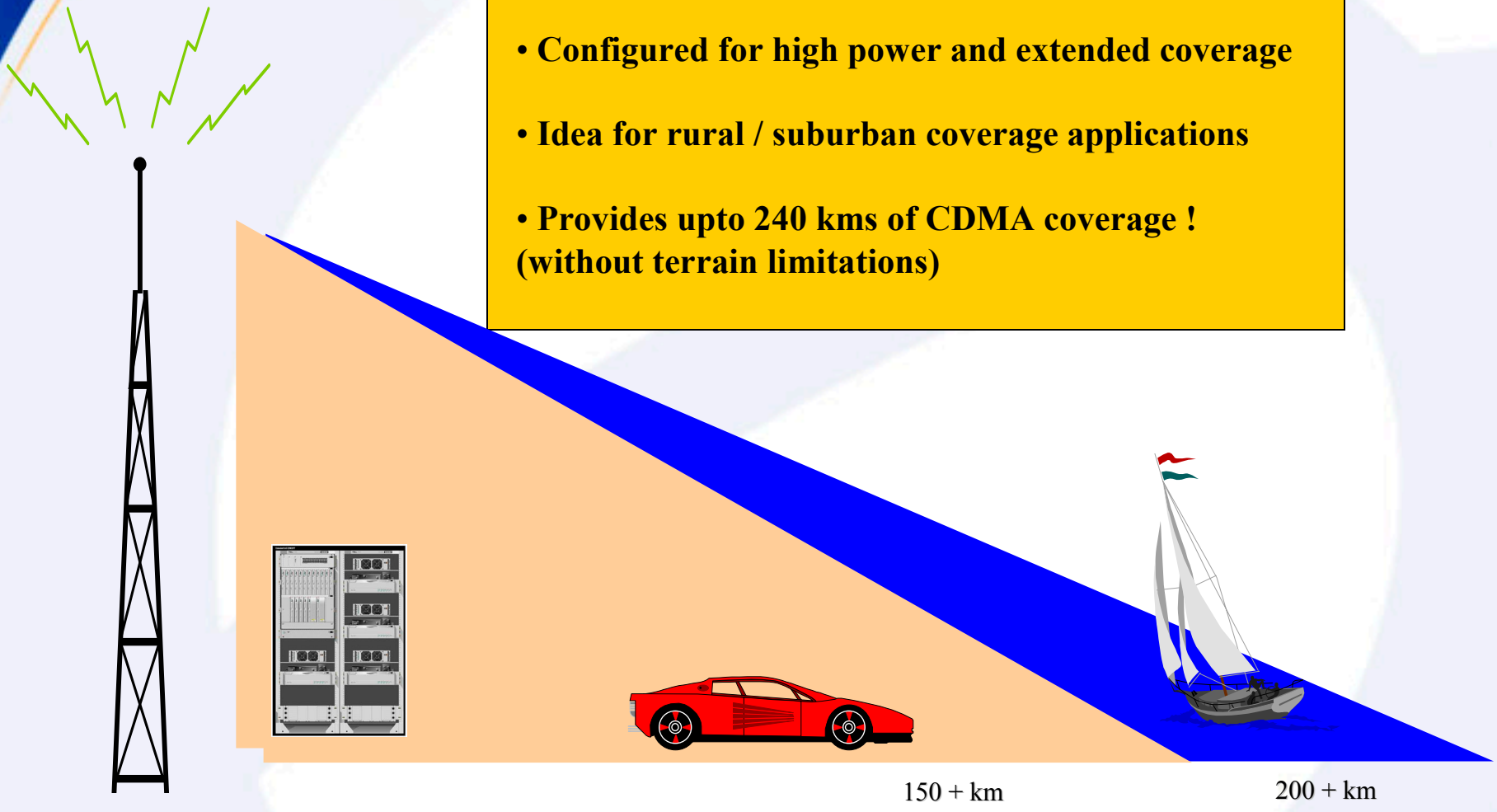
Features for Rural Applications

- **Uses Metrocell BTS**
- **Configured for high power and extended coverage**
- **Idea for rural / suburban coverage applications**
- **Provides upto 240 kms of CDMA coverage ! (without terrain limitations)**



10 times normal coverage for non-terrain limited areas

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"Boomer Cell" Deployment – Key Features

- Metrocell configured for high power and extended coverage for rural / suburban coverage applications
- Provides upto 240 kms of CDMA coverage (without terrain limitations)
- Nortel has developed 2 unique features to deliver extended coverage "Boomer Cells"
  - High power PA – Provides 54 W PA power per sector
  - Extended coverage XCEM – Capability to extend sector radius upto 240 km
  - Additionally deploy LNA to improve reverse link budget
- Can be deployed in Omni or 3 sectored configuration
- Provides scalable, expandable deployment options designed specifically for low density areas.
  - Ideal for suburban and rural coverage deployments

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“Boomer Cell” Deployment – Key Benefits

- Works for mobility or fixed wireless applications
- Minimizes initial capital investment to cover large areas
- Supports common sparing with Nortel Networks Metrocell and Minicell base stations
- Simplifies maintenance and upgrades
- Supports the same smooth evolution to next-generation technologies of the current Metrocell product line
- Provides increased coverage – superior voice quality
- Improved performance in rural / suburban areas
- Overall lower operational costs

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